

RAISED FLOOR SYSTEM AND SUPPORT APPARATUS

CROSS REFERENCE TO RELATED APPLICATIONS

5 The present application is a continuation of co-pending U.S. Application Serial No. 09/818,318 filed March 27, 2001, which is a continuation-in-part of co-pending U.S. Application Serial No. 09/524,033 filed March 13, 2000 which is a continuation-in-part of co-pending International Application Serial No. PCT/US98/19051, with international filing date of September 11, 1998; which application designates the United States of America and claims priority to U.S. Application Serial No. 08/927,506 filed September 11, 1997 as a continuation-in-part application. The contents of each of these applications
10 are hereby incorporated by reference.

BACKGROUND

1. Technical Field

The present disclosure relates to raised floor systems and more particularly to a cable support assembly for use in connection with a raised floor system.

15 2. Description of Related Art

Raised floor systems have been developed to provide the additional utility space needed in various different conduit or cable intensive environments where the original construction did not provide adequate means of accommodating the vast amount of conduit or cable. For example, probably the most common environment requiring vast
20 amounts of additional protected space is for large computing systems. Such installations were typically made in facilities which simply were not designed to accommodate the vast amount of cable runs required to operate the typical large computer system. Other applications where additional utility space is required include mechanical systems, e.g., heating, ventilating and air conditioning systems.

A common problem experienced in utilizing raised floor systems is maintaining organization of the various cables, conduits, pipes, etc. which are routed beneath the floor system. One solution to this problem is to provide a cable tray system beneath the floor panels of the raised floor to contain and direct cables along their
5 respective pathways. An example of such a cable tray system is disclosed in U.S. Patent No. 4,596,095 which issued on June 24, 1986 to Chalfant (the "'095 Chalfant Patent"). The '095 Chalfant Patent features a modular cable tray assembly which is formed from modular sections which include a number of different components all of which must be separately assembled to form the cable tray. For example, the cable tray includes
10 separate straight sections, horizontal bend sections, horizontal tee sections, horizontal cross-intersection sections, as well as splice plates to connect the various components to each other as well as supporting the assembled cable tray above the building floor. Such a cable tray assembly is, therefore, independent of the raised floor system.

One drawback of such a raised floor and cable support system is the
15 additional labor required to assemble the various components of the separate raised floor and cable support systems. In geographic regions with particularly high labor rates, the cost of erecting such a labor intensive dual system could prove to be cost prohibitive.

Another drawback of such a system is that the amount of space required by the structural supporting components of the two separate systems leaves less space
20 available for carrying and organizing larger numbers of cable runs.

Yet another drawback of installing independent raised floor and cable support systems is the cost of procuring the materials required for two separate support structures. These additional labor and material costs can significantly increase the overall cost of installing a complete system.

25 An alternative solution to supporting cable runs below a raised floor assembly is proposed in U.S. Patent No. 5,548,932 which issued on August 27, 1996 to Mead (the "'932 Mead Patent"). The '932 Mead Patent features a height adjustable cable tray support system which includes a number of separate components which must be assembled to form the cable support system. Plates which support the cable tray are

secured by welding or other methods to the pedestals of the existing raised floor system featured in the '932 Mead Patent. Additionally, support rods are required in the '932 Mead Patent cable tray support system, which support the cable tray on the support plates.

5 One disadvantage of such a system is the labor intensive nature of the installation. In particular, each support plate must be separately secured to the floor system pedestals and the support rods and cable tray sections must be installed. This combined with the cost of the material components required for such a system can add significant cost to the installation of the complete system.

10 Accordingly, there is a continuing need for improved raised floor and cable management systems which require fewer number of components. A need also exists for raised floor and cable management systems which are easier to install than existing systems and which provide increased storage capacity and accessibility.

SUMMARY

15 The present disclosure provides a raised floor system which overcomes the above-noted and other disadvantages of existing raised floor and cable management systems. Additionally, the present disclosure provides a raised floor system which requires many fewer components to assemble thereby resulting in greatly reduced material and labor costs to install a complete raised floor and cable management system
20 or to upgrade an existing raised floor system with the presently disclosed cable support assembly.

 In one aspect of the present disclosure a raised floor system is provided which includes a raised floor system, which includes a plurality of support pedestals; a plurality of floor panels; and a cable support apparatus which includes: a first elongated
25 stringer element defining a horizontally disposed surface which is configured and dimensioned to support a portion of at least one of the plurality of floor panels, the first elongated stringer element being supported a predetermined distance away from a base by a first pair of the plurality of support pedestals; a second elongated stringer element

defining a horizontally disposed surface which is configured and dimensioned to support a portion of at least one of the plurality of floor panels, the second elongated stringer element being supported a predetermined distance away from a base by a second pair of the plurality of support pedestals and

5 a channel section suspended from the first and second stringer elements, the channel section being configured and dimensioned to support lengths of cable thereon.

The channel section may be formed of an open architecture defining a plurality of openings therein.

Additionally, the channel section may be formed of wire stock. The channel section may
10 further include a plurality of support members extending from the first elongated stringer element to the second elongated stringer element.

In such an arrangement, the plurality of support members are preferably maintained at a predetermined distance from each other.

The channel section may be suspended from the first and second elongated
15 stringers by permanently securing the channel section to the first and second elongated stringers.

In another aspect of the present disclosure a cable support apparatus is provided for use with a raised floor system including a plurality of support pedestals and floor panels. The cable support apparatus includes first and second stringer elements,
20 each of the stringer elements being adapted for removable engagement with respective support pedestals of a raised floor system such that the first and second stringer elements interconnect the respective support pedestals of the raised floor system, each of the first and second stringer elements defining a horizontally disposed upper surface which is configured and dimensioned to support a portion of a floor panel of the raised floor
25 system; and a channel section suspended from the first and second stringer elements, the channel section being configured and dimensioned to support lengths of cable thereon.

In yet another aspect of the present disclosure, a modular cable support assembly is provided which includes a plurality of support pedestals; a plurality of cable support apparatus each of which includes: a first elongated stringer element defining a

horizontally disposed upper surface thereof which is configured and dimensioned to support at least a portion of a floor panel, the first elongated stringer element being supported a predetermined distance away from a base by a first pair of the plurality of support pedestals; a second elongated stringer element defining a horizontally disposed
5 upper surface thereof which is configured and dimensioned to support at least a portion of a floor panel, the second elongated stringer element being supported a predetermined distance away from a base by a second pair of the plurality of support pedestals; and a channel section suspended from the first and second stringer elements, the channel section being configured and dimensioned to support lengths of cable thereon.

10 In a still further aspect of the present disclosure, a cable support apparatus is provided for use with a raised floor system including a plurality of support pedestals, stringers and floor panels, the cable support apparatus including a channel section configured and dimensioned to support lengths of cable thereon; and means for suspending the channel section from the stringers of the raised floor system. The channel
15 section may be formed of an open architecture.

In a further embodiment, the present disclosure provides a support apparatus for use with a raised floor system including a plurality of support pedestals and floor panels. The support apparatus includes a support bracket having first and second end portions being configured and dimensioned to rest upon at least a portion of a support
20 pedestal of a raised floor system and beneath a floor panel of the raised floor system. The embodiment also includes an intermediate portion extending between the first and second end portions, and an article support member depending from the intermediate portion to support articles thereon a distance below the raised floor panels and a distance above a base.

25 A still further embodiment includes first and second support brackets each having first and second end portions being configured and dimensioned to rest upon at least a portion of a support pedestal of a raised floor system and beneath a floor panel of the raised floor system, and an intermediate portion extending between the first and second end portions, an article support member depending from the first and second

support brackets to support articles thereon a distance below the raised floor panels and a distance above a base.

In a still further embodiment, an article support apparatus is provided for use with a raised floor system. The support apparatus includes an article support member
5 configured to support articles thereon and a mounting mechanism, such as a suspension assembly, adapted to connect the article support member to a stringer element of the raised floor system.

The present disclosure also provides a method of installing a support apparatus in a raised floor system including a plurality of support pedestals and floor
10 panels. The method includes the steps of inserting a first end portion of a support bracket configured and dimensioned to fit in an opening defined at least partially by a portion of a first support pedestal disposed beneath a floor panel, moving the first end portion of the support bracket laterally towards the first support pedestal such that a second end portion of the support bracket moves away from a second support pedestal spaced a
15 predetermined distance away from the first support pedestal, elevating the second end portion of the support bracket into horizontal alignment with an opening defined at least partially by a portion of the second support pedestal, and moving the second end portion of the support apparatus toward the second support pedestal such that the first and second end portions of the support apparatus are positioned in the respective openings defined at
20 least partially by portions of the first and second support pedestals.

The present disclosure further provides alternative method of installing an article support apparatus in a raised floor system which includes a plurality of support pedestals, stringer elements and floor panels. The method includes the steps of providing an article support apparatus configured and dimensioned to support articles thereon and a
25 suspension assembly connected to the article support member, the suspension assembly including an adjustable fastener; inserting the adjustable fastener of the suspension assembly into a channel portion defined in a stringer of the raised floor system; and adjusting the adjustable fastener and thereby mounting the article support member to the stringer of the raised floor system.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the presently disclosed raised floor system and cable support assembly are described herein with reference to the drawings, wherein:

FIG. 1 is a perspective view of one embodiment of a raised floor system
5 constructed in accordance with the present disclosure;

FIG. 2 is a perspective view of a cable support assembly embodiment constructed in accordance with the present disclosure;

FIG. 2A is a perspective view of an alternative embodiment of a cable support assembly constructed in accordance with the present disclosure;

10 FIG. 3 is a side view of the cable support assembly of FIG. 2 in place in a raised floor system;

FIG. 4 is an enlarged partial perspective view of a cable support assembly in a raised floor system of the present disclosure;

15 FIG. 5 is a side view showing the cable support assembly partially cut away as installed in the raised floor system of the present disclosure;

FIG. 6 is a perspective view of a further embodiment of the presently disclosed cable support assembly;

FIG. 7 is a side partial view of an alternative embodiment for mounting the cable support assembly to stringers of a raised floor system;

20 FIG. 8 is a side partial view of a further alternative embodiment for mounting the cable support assembly to stringers of a raised floor system;

FIG. 9. is a perspective view with parts separated of one embodiment of a secondary support apparatus and components of a raised floor assembly, constructed in accordance with the present disclosure;

25 FIG. 10A is a top view of a bearing surface of a support pedestal;

FIG. 10B is a top view of a bearing surface of a further support pedestal;

FIG. 11 is a side view of an assembly sequence of a secondary support apparatus;

FIG. 12 is a side view of a further assembly sequence of a support apparatus;

FIG. 13 is a side view of a further assembly sequence of a support apparatus;

5 FIG. 14 is an enlarged partial perspective view showing one end of a secondary support apparatus assembled in a raised floor support system;

FIG. 15 is a perspective view with parts separated of a further embodiment of a secondary support apparatus and components of a raised floor assembly, constructed in accordance with the present disclosure;

10 FIG. 16 is a perspective view of an alternative embodiment of a cable support assembly incorporated in a raised floor support system constructed in accordance with the present disclosure;

FIG. 17 is a perspective view with parts separated of one section of a cable support assembly of the embodiment of FIG. 16;

15 FIG. 18 is a perspective view of an alternative embodiment of a cable support assembly section constructed in accordance with the present disclosure;

FIG. 19 is a partial perspective view of a further alternative embodiment of a support bracket;

20 FIG. 20A is a side schematic view of an installation step for the embodiment of FIG. 19;

FIG. 20B is a view similar to FIG. 20A of a further installation step;

FIG. 20C is a further view similar to FIGs. 20A and 20B of a further installation step;

25 FIG. 21 is a perspective view of a further alternative embodiment of a support assembly in association with a raised floor system;

FIG. 22 is a perspective view showing a portion of an article support member of the embodiment of FIG. 21; and

FIG. 23 is a perspective view showing an article support member as mounted to a stringer element, in accordance with the embodiment of FIG. 21.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now in specific detail to the drawings in which like reference numerals identify similar or identical elements throughout the several views, and initially to FIG. 1, one embodiment of a raised floor system constructed in accordance with the present disclosure is shown generally as raised floor system 10.

Generally, raised floor system 10 includes a series of support pedestals such as stanchions 12 which are disposed in a predetermined array on a base such as floor 13. A cable support assembly is provided in raised floor system 10 and includes a series of cable support apparatus such as cable baskets 14 which are disposed relative one another to form a predetermined passageway for carrying cables or the like thereon. Preferably cable baskets 14 form an integral part of floor system 10. Stanchions 12 are interconnected by stringer members 16 so as to define a lattice work which receives individual floor panels 18 therein to form the completed raised floor system 10.

In certain installations it may be desirable or necessary to install the cable support assembly as a stand-alone modular assembly. It is within the scope of the present disclosure, that in such an installation, cable baskets 14 will be supported a predetermined distance above the building floor 13 by independent stanchions 12 or other suitable supports which are not also used to support the raised floor system 10.

Referring now to FIG. 2, cable basket 14 includes first and second elongated stringer elements 20 and 22, respectively. A channel section is suspended from stringers 20 and 22 so as to form a portion of a passageway for supporting cable runs thereon. In the illustrated embodiment, the channel section is formed of an open ended wire stock basket having longitudinal sections 26 attached to transverse sections 24. Transverse sections 24 include riser portions or legs 28 which are attached to the underside of stringers 20 and 22. The various elements of cable support assembly 14 are preferably joined by suitable known techniques, such as by welding.

Although the illustrated channel sections are formed of wire stock material, it is within the scope of the present disclosure to use other materials as well. For example, the channel section may be formed of solid or woven fabrications of various

metals or any other material suitable for supporting cable runs thereon. One illustrative example of such an alternative channel section is shown in FIG. 2A wherein channel section 114 includes vertical side wall portions 114A and 114B which extend upwardly from a central horizontal bottom panel 114C. Such a channel section 114 may be particularly useful in supporting equipment or the like above the base or building floor. Also illustrated in FIG. 2A is an alternative mounting system which will be described in greater detail in connection with the embodiment of FIGs. 9-14.

Referring now to FIGs. 3-5, the integration of cable baskets 14 into raised floor system 10 will now be described in detail. Preferably, a single section of cable basket 14 is supported by four stanchions 12 (as shown in FIG. 1). However, it is within the scope of the present disclosure that cable baskets 14 may be modified so as to be supported by more or less than four stanchions 12.

As shown in FIG. 3, cable baskets 14 are supported by stanchions 12 such that the longitudinal and transverse elements 26 and 24 respectively are spaced a predetermined distance from the permanent floor 13. When installed, cable baskets 14 do not interfere with the placement or fit of floor panels 18. Rather, cable baskets 14 are designed to be incorporated into existing raised floor systems without departing from the factory design specifications of the floor system. For such installations, cable baskets 14 replace parallel end to end links of stringers 16 from the existing raised floor system.

As shown in FIG. 4, cable support assembly sections 14 include stringer elements such as stringers 20 and 22 which have a cross sectional "top hat" shape that includes an inverted U-shaped cross section portion having flanges 32 and 34 formed on either side. Horizontal surface 30 forms the uppermost surface of stringers 20 and 22. It is on surface 30 which a peripheral flange 36 formed on floor panels 18 rests. As best illustrated in FIG. 5, the peripheral flanges 36 of adjacent floor panels 18 are both supported by a single stringer element 20 or 22 on surface 30. In order to maintain the relative positioning of stringer elements 20 and 22 with respect to stanchion 12, stringer elements 20 and 22 are provided with notched portions 38 which are configured and dimensioned to fit over bracket portions 40 of stanchion base plate 42.

Stringer elements 20 and 22 are further provided with preformed holes 44 which when properly installed are vertically aligned with preformed holes 46 formed in stanchion base plate 42. In this manner, stringer elements 20 and 22 may be secured to stanchion 12 to provide added structural integrity to the overall system. As is common in conventional floor systems, floor system 10 is preferably provided with a height adjustment mechanism to adjust the height of stanchion base plate 42 in order to accommodate slight variances in the subfloor 13. This height adjustment capability may be facilitated by, for example, threaded stud 48 being received in a threaded bore 50 formed in base plate 42 at one end and in a threaded opening of stanchion 12. A nut 52 is provided and is threaded around stud 48 positioned adjacent the top of stanchion tube to facilitate adjustment and locking of the vertical positioning of base plate 42.

Referring to FIG. 6, an alternative method of attaching the cable basket to the stringers is shown wherein cable basket 14 has portions 14a and 14b which are formed extending outwardly from the upper portions of riser legs 28. Stringers 120 and 122, which are otherwise the same as stringers 20 and 22, are provided with a series of through-holes 120a and 120b, respectively, which may be punched out during formation of the stringers. In this manner, cable basket 14 may be suspended from stringers by inserting leg portions 14a and 14b in through-holes 120a and 120b. It is envisioned that all of the stringers of a raised floor system may be provided with through-holes similar to 120a and 120b so that a cable support system may be installed at any time and placed between any parallel rows of stringers having such support holes.

Alternatively, in existing raised floor systems which do not already have stringers with pre-formed cable basket receiving holes, such as holes 120a and 120b, the stringers positioned where it is desired to support a series of cable baskets 14 could be replaced with stringers having the pre-formed holes.

Referring to FIG. 7, in another alternative embodiment for mounting or suspending cable baskets 14 from stringers 20, angled brackets 21 are provided which have leg portions 21a and 21b. Leg portion 21a includes a through hole (shown in phantom lines) which receives leg portion 14a of cable basket 14. Leg portion 21b is

bolted into the channel formed in the underside of stringer 20 by an adjustable fastener or expanding fastener such as wedge-bolt.25.

Referring to FIG. 8, in a still further alternative embodiment for suspending cable baskets 14 from stringers 20, a series of clips 23 are positioned on stringers 20 by having leg portions 23a and 23b rest upon flanges 32 and 34, respectively. Leg portions 14a of baskets 14 are inserted into receiving holes formed in clips 23. Thus, baskets 14 are suspended from clips 23. In this manner, existing floor system stringers could be utilized to support the added cable baskets defining the cable support assembly.

Referring now to FIGS. 9-14, a secondary support apparatus for use in conjunction with a raised floor system will now be described in detail. A support bracket 220 is provided which is configured and dimensioned to support an article support member such as basket 14. Basket 14 has been described with respect to previously described embodiments of the present disclosure and will not be addressed in further detail herein.

In the embodiment illustrated in FIG. 9, only one frame 220, one pair of pedestals 12, and one stringer element 16 are shown. A second pair of pedestals 12, stringer element 16, floor panel 18 (FIG. 1), and frame 220 which are identical to the illustrated structure form part of one section of a raised floor system but are not shown for sake of clarity.

Support bracket 220 is preferably stamped out of a flat metal stock and is configured and dimensioned to depend from an adjacent pair of pedestals 12 of a raised floor assembly. However, it is envisioned that for different applications, support bracket may be formed of materials having other cross-sectional geometries, such as for example, round stock.

Support bracket 220 is particularly adapted to be installed in an existing raised floor assembly, such as the one illustrated in FIG. 1. However, support bracket 220 advantageously does not require the removal or substitution of the existing stringer elements 16 of the raised floor assembly. Installation of frames 220 does not alter the configuration or compromise the existing raised floor assembly.

Referring to FIGS. 10A-13, support bracket 220 includes an upper portion 220a and a lower portion 220b.

Lower portion 220b extends downwardly away from upper portion 220a. Support bracket 220 includes notches 220c formed in the lower edges of transversely extending portions which extend out each end of support bracket 220.

To install support bracket 220, as shown in FIG. 11, a first end is inserted in the U-shaped opening of stringer element 16 and passed over bracket portion 40 of stanchion base plate 42. Support bracket 220 is slid over until the second end is clear of bracket portion 40 of stanchion base plate 42 of the adjacent pedestal 12. As shown in FIG. 12, the second end of support bracket 220 is elevated until the transversely extended portion is clear of the top of bracket portion 40. Finally, as shown in FIG. 13, support bracket 220 is moved so that notches 220c align with the respective bracket portions 40 of stanchion base plates 42 and support bracket is lowered so that notches 220c rest on the respective bracket portions 40.

In this manner, mounting holes which are formed in the lower portion 220b are situated below the bottom of stringer elements 16. Thus, as shown in FIG. 14, basket 14 may then be inserted in a similar fashion as shown and described with respect to the embodiment of FIG. 6. Once installed, basket 14 is locked in place.

A further embodiment of a support apparatus for use in conjunction with a raised floor assembly is illustrated in FIG. 15 as support bracket 320. Support bracket 320 includes similar mounting structure to support bracket 220. Support bracket 320 includes lower portion 320 which extends downwardly a predetermined distance from upper portion 320a. Lower portion 320b may be any desired length up to the limit imposed by whatever surface, be it planar or irregular, is between adjacent pedestals 12. Thus, lower portion 320b provides a mounting surface which is suspended above the surface which the raised floor assembly is positioned over. In this manner, a variety of articles may be supported below the floor panels of the raised floor assembly but above the surface upon which the raised floor assembly rests. For example, a power strip 330 may be mounted to support bracket 320.

Referring to FIG. 16, an alternative embodiment of a cable support assembly as incorporated in the structural support system of a raised floor system is shown disposed along a single linear array of stanchions 12 of a raised floor system. As shown in FIG. 17, a cable support assembly section 414 defines two separate cable support pathways which are defined by a series of spaced apart cable support bracket members each having a pair of partially enclosed areas 415 and 417 defined by segments 415a, 415b, 415c; and 417a, 417b, 417c, respectively. The cable support brackets are preferably formed of stock which is readily formed into the desired shape such as illustrated in FIG. 17, for example, wire stock. Each of the cable support brackets are provided with a loop section 419 at the outboard ends of the partially enclosed areas 415 and 417. Loop sections 419 may be formed such that the loop is oriented outwardly from the partially enclosed areas 415 and 417, as illustrated in FIG. 17, or loops 419 may be formed to be oriented facing inwardly in the partially enclosed areas.

FIG. 18 illustrates a further alternative embodiment of a cable support assembly section 514 which is similar to cable support assembly section 414 of FIG. 17 except that a single cable pathway is defined by a series of cable bracket members secured to a stinger element 16. Each of the cable support bracket members include a partially enclosed area 515 defined by segments 515a, 515b, and 515c. A loop portion 519 is also formed at the outboard end of the partially enclosed area 515 and may be formed as noted above with respect to FIG. 17.

Referring now to FIGS. 19-20C, a further alternative support apparatus embodiment for use in conjunction with a raised floor system will now be described in detail. A support bracket 620 is provided which is configured and dimensioned to support an article support member such as those featured in the previously described embodiments.

In FIGS. 19-20C, only one support bracket 620, and the top plate portion of one pair of pedestals 112, and a portion of a cable support basket 614 are shown. In one particularly useful application, a single support bracket 620 may be utilized to mount an article support member such as cable support assembly section 414 (FIGS. 16 and 17)

or cable support section 514 (FIG. 18). The article support member may be either a single section like that shown in FIG. 15 or it may form a single section in a series of sections arranged to form one or more pathways for cables, as shown in FIG. 16.

Alternatively, a pair of support brackets may be utilized to support the two
5 sides of broader article support member, such as cable support basket 614 (shown in partial view in FIG. 19). Cable support basket 614 is similar to basket 14 except that stringer element 16 is not utilized. Rather, support bracket 620 takes its place. In such an application, a second pair of pedestals 112, and support bracket 620 which are identical to the illustrated structure form the other half of the presently disclosed embodiment, but are
10 not shown for sake of clarity.

In applications such as those exemplary illustrations described above as well as others envisioned within the scope of the present disclosure, instead of being attached to stringers 16, a series of article support members are attached to a series of support brackets 620, respectively. Such a configuration is particularly useful in raised
15 floor systems wherein it is either not desired or not necessary to replace the stringers of a raised floor system or no separate stringer elements are present.

In a raised floor system which does not have separate stringer elements, the floor tiles themselves are configured and dimensioned to provide the necessary support to meet the load requirements for the floor system.

20 Installation of an assembled support structure which includes support bracket 620 is shown schematically in FIGs. 20A, 20B, and 20C. Such installation is similar to that of bracket 220 as shown and described in connection with FIGs. 11, 12, and 13. The principal difference being that bracket 620 includes neck portions 620a and 620b formed at either end. In this manner, bracket 620 facilitates the positioning of an
25 attached article support member at a vertical level spaced a predetermined distance below the plane of the pedestal top portions 612. Brackets 620 thus provide greater versatility in that article support members attached thereto may be installed in raised floor systems which have stringers, as shown in FIGs. 9-13, or in raised floor systems which do not include stringers, as shown in FIGs. 19-20C.

As illustrated in FIGs. 20A, 20B, and 20C support bracket 620 is configured and dimensioned to fit in an opening 612a formed in the pedestal top portion 612, such that upper horizontal extensions 620c and 620d are alternately inserted into openings 612a of adjacent pedestals as illustrated by arrows "A", "B", and "C" in FIGs. 20A, 20B, and 20C.

Support brackets 620 are shown formed of rectangular cross-section bar stock. However, it is envisioned that for different applications, support brackets 620 may be formed of materials having other cross-sectional geometries.

Support brackets 620 are particularly adapted to be installed in an existing raised floor assembly which may or may not include separate stringer elements. This versatile feature is possible because, support brackets 620 advantageously do not require the removal or substitution of existing stringer elements 16 of raised floor assembly. Installation of support brackets 620 does not alter the configuration or compromise the existing raised floor assembly. Upon installation, support brackets 620 may be secured in place by suitable fasteners, such as, for example, set screw 613 shown in FIG. 19.

Referring now to FIGS. 21-23, a further alternative support apparatus for use in association with a raised floor system is described in detail hereinafter. An article support apparatus 720 is provided which is configured and dimensioned to mount to a stringer element 710 which is in turn configured to mount on the support pedestals 12 of raised floor system 10.

As in FIG. 22 where only a portion of article support apparatus 720 is shown, article support apparatus 720 includes article support member 722 and mounting mechanism such as suspension assembly 730. Article support member 722 is configured to support articles, such as cables, thereon. Suspension assembly 730 includes a connection bar member such as bracket 732 connected to the support member 722, and an adjustable fastener 734. Adjustable fastener 734 and bracket 732 may be in various configurations to provide adequate mounting of the support member 722 to the stringer element of the raised floor system. For example, see the embodiment of FIGS. 7 and 8 as described hereinabove. In the present embodiment of FIGS. 21-23, adjustable fastener

734 includes a base or head portion 736 (shown in phantom lines under bracket 732) an elongated shank portion 738 extending from head portion 736 and a latch member 740. The fastener 734 may further include a spring 742 disposed between the latch member 740 and the head portion 736 or the bar 732.

5 As shown in FIG. 21, for the mounting of the support apparatus 720 to the stringer 710, latch members 740 of the adjustable fasteners 734 are initially aligned with the lateral opening of channel portions 712 (best shown at the left side of article support member 722 in FIG. 21) defined along the bottom of stringer element 710.

 The mounting operation of article support apparatus 720 is best shown in
10 FIG. 23. Article support member is urged upwardly such that latch members 740 enter into channel 712 and are clear of end surfaces 714 as shown in FIG. 23. The disposition of spring 742 between bracket 732 and latch member 740 coaxially about elongated shank portion 738 facilitates latch member 740 remaining vertically clear above end surfaces 714. After inserting the latch members 740 to the channels 712, each head
15 portion 736 of the adjustable fasteners 734 is rotated causing the respective latch member 740 to rotate out of alignment with channel 712 and be drawn tightly against end surfaces 714 of the stringer 710. Latch member 740 may be elongated sufficiently such that upon rotation, the ends thereof abut the inner wall of channel 712 to prevent further rotation of the latch member 740 as head portion 736 is further rotated.

20 Although the illustrative embodiments of the present disclosure have been described herein with reference to the accompanying drawings, it is to be understood that the disclosure is not limited to those precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the disclosure. All such changes and modifications are intended to
25 be included within the scope of the appended claims.